Klamath River Fall Chinook Age-Specific Escapement, 2003 Run

Klamath River Technical Advisory Team
1 March 2004

Executive Summary

The number of Klamath River fall chinook returning to the Klamath River Basin in 2003 was estimated to be

	Run Size	
Age	*Number*	*Proportion*
2	3,845	0.02
3	94,147	0.48
4	96,559	0.49
5	862	0.01
Total	195,413	

Klamath Ocean Harvest Model preseason forecasts of fall chinook to the Klamath River Basin and their postseason estimates are:

	Adults	
Sector	*Preseason Forecast*	*Postseason Estimate*
Run Size	113,200	191,568
Fishery Mortality		
Tribal Harvest	41,400	29,897
Recreational Harvest	10,800	9,701
Dropoff Mortality	3,800	2,798
Escapement		
Hatchery Spawners	22,200	61,775
Natural Area Spawners	35,000	87,397

Age-specific returns to Basin hatcheries, spawning grounds, in-Basin harvest by tribal and recreational fisheries, and the dropoff (non-catch) mortality associated with these fisheries are presented in Table 1.

Introduction

This report describes the data and methods used by the Klamath River Technical Advisory Team (KRTAT) to estimate age-specific numbers of fall chinook returning to the Basin in 2003. The estimates provided in this report are compatible and consistent with the so-called Klamath River Megatable (CDFG 2004) and with the 2004 forecast of ocean stock abundance (KRTAT 2004).

Age-specific escapement estimates for 2003 and previous years, coupled with the coded-wire tag recovery data on the Basin's hatchery stocks, allow for a cohort reconstruction of the hatchery and natural components of Klamath River fall chinook (KRTAT 2004, Goldwasser et al. 2001). Cohort reconstruction results enable forecasts to be developed of the upcoming year's ocean stock abundance, percent of spawners expected in natural areas and ocean fishery contact rates, as described in a companion report (KRTAT 2004). These forecasts are essential inputs to the Klamath Ocean Harvest Model (Mohr et al. 2001); the model used by the Pacific Fishery Management Council to forecast the effect of fisheries on the Klamath River fall chinook stock.

Methods

The basic approach used by the KRTAT to develop age-specific estimates of returning fall chinook to the Basin's hatcheries, spawning grounds, and fisheries, was to develop an age-composition estimate for each sector and then apply this composition to the corresponding sector total (age-unspecific) reported in the Klamath River Megatable. Random sampling methods of various types were used throughout the Basin (Table 2) to obtain the data from which the Megatable totals and the age-composition estimates were derived.

Where possible, an age-composition estimate was based on the reading of a random sample of scales (Table 3). For Trinity River ageing, each scale was read independently by two readers, and a third reader was used to resolve any disagreement between the two primary readers. For Klamath River ageing, each scale was read independently by two readers, and any disagreement was resolved by the two readers re-reading the scale together and agreeing upon a single age. Statistical methods (Kimura and Chikuni 1987, Cook and Lord 1978, Cook 1983) were then used to correct for the possibility of reader ageing-bias, by correlating known-age cwt scales with their corresponding scale-read age assignments.

In some cases, however, the scale sample was either known or thought to be non-random with respect to the age-2 ("jack") component. In these cases, the so-called length "cutoff" method (all fish less than a certain length are assumed to be jacks, and all fish greater than that length are assumed to be adults) was used to estimate the jack component percentage based on a random sample of length frequencies. The length "cutoff" value varied by sector and was based on the location of the sample length frequency nadir, and if appropriate, known-age (cwt) length frequencies. Scale reading was used to estimate the adult age-composition in these instances.

In still other cases, the scale sample size was insufficient to develop a reliable age-composition estimate, or was altogether lacking. In these cases the KRTAT used "surrogate" age-composition estimates from other sectors where such estimates were available, and were thought most likely to reflect the age-composition of the sector of interest.

For Trinity River natural area spawners, an indirect method was used as follows. Age-specific numbers of fall chinook passing the Willow Creek Weir (WCW) were estimated by applying the WCW scale age-composition to the above WCW total run size estimate. Next, the age-composition of Trinity River Hatchery (TRH) returns, and angler harvest between WCW and TRH, were determined based on scale-age assessments and any known-age cwt fish collected at these recovery points. Natural area spawner age-composition was then taken as the difference between the WCW run-size at age and the sum of TRH returns and the angler harvest above WCW.

For the Trinity River natural area spawners below WCW, total escapement was determined through redd surveys conducted in the main-stem and tributary streams (Table 2). Age-structure was assigned from scale collections obtained in these areas.

Results

The specific protocols used to develop age-composition estimates in each sector are provided in Table 4, and a summary of the KRTAT surrounding discussion is given in Appendices A and B for the Klamath and Trinity Rivers, respectively.

A total of 22,447 scales from 16 different sectors were provided for this analysis (Table 3), and of these 1,895 and 2,470 were scales collected from cwt fish from the Klamath and Trinity Rivers, respectively. The scale read-age results for these cwt fish provides a direct check on the accuracy of the scale read-age assignments, and allowed estimation of the known-age, read-age "validation" matrix used in the statistical bias-correction methods (Tables 5a, 5b). Overall, the scale readings were quite accurate and precise, particularly in the case of the Trinity River (>96% accuracy, ages 2,3,4). There were no cwts for validation of read-age-5 scales. For the Klamath River, the

accuracy indicated from comparing scale read-ages to known-ages (cwt fish) was greater than 87%. The statistical bias-correction methods employed are intended to correct for scale-reading bias, but the methods assume that the known-age, read-age validation matrices are themselves well-estimated (Kimura and Chikuni 1987).

The resulting sector-specific age-composition is given in Table 6, and summarized in Table 1. Calculations underlying the results for the Klamath and Trinity Rivers are presented in Appendices C and D, respectively.

Literature Cited

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Table 1. Age composition of the 2003 Klamath River fall chinook run as determined by the Klamath River Technical Advisory Team.

Escapement & Harvest	AGE 2	3	4	5	Total Adults	Total Run
Hatchery Spawners						
Iron Gate Hatchery (IGH)	290	17,427	14,459	84	31,970	32,260
Trinity River Hatchery (TRH)	586	18,155	11,650	0	29,805	30,391
Hatchery Spawner subtotal	**876**	**35,582**	**26,109**	**84**	**61,775**	**62,651**
Natural Spawners						
Salmon River Basin	73	1,245	2,039	17	3,302	3,375
Scott River Basin	65	4,399	7,559	30	11,988	12,053
Shasta River Basin	155	2,798	1,325	11	4,134	4,289
Bogus Creek Basin	183	8,258	6,760	0	15,018	15,201
Klamath River main-stem (IGH to Shasta R)	237	6580	7407	89	14,076	14,313
Klamath River main-stem (Shasta R to Indian Cr)	61	1704	1919	23	3,646	3,707
Klamath River tributaries (above Reservation)	38	831	924	6	1,761	1,799
Klamath River tributaries (Yurok Reservation)	31	413	676	6	1,094	1,125
Klamath Basin subtotal	843	26,228	28,609	182	55,019	55,862
Trinity River main-stem (above WCW)	1,030	19,226	11,621	226	31,074	32,104
Trinity River main-stem (below WCW)	26	119	127	13	258	284
Trinity River tributaries (above Reservation)	109	135	454	13	602	711
Trinity River tributaries (Hoopa Reservation)	80	100	335	10	444	524
Trinity Basin subtotal	1,245	19,580	12,537	262	32,378	33,623
Natural Spawners subtotal	**2,088**	**45,808**	**41,146**	**444**	**87,397**	**89,485**
Total Spawner Escapement	**2,964**	**81,390**	**67,255**	**528**	**149,172**	**152,136**
Recreational Harvest						
Klamath River (below Hwy 101 bridge)	180	816	770	4	1,589	1,769
Klamath River (Hwy 101 to Coon Cr. Falls)	369	1,718	1,611	8	3,336	3,705
Klamath River (Coon Cr. Falls to IGH)	40	1,120	1,261	15	2,397	2,437
Trinity River Basin (above WCW)	175	1,116	754	0	1,870	2,045
Trinity River Basin (below WCW)	52	304	205	0	509	561
Subtotals	**816**	**5,074**	**4,601**	**27**	**9,701**	**10,517**
Tribal Harvest						
Klamath River (below Hwy 101)	15	3,947	18,362	239	22,548	22,563
Klamath River (Hwy 101 to Trinity mouth)	17	1,636	2,897	44	4,578	4,595
Trinity River (Hoopa Reservation)	12	1,390	1,381	0	2,771	2,783
Subtotals	**44**	**6,973**	**22,640**	**283**	**29,897**	**29,941**
Total Harvest	**860**	**12,047**	**27,241**	**310**	**39,598**	**40,458**
Totals						
Harvest and Escapement	3,824	93,437	94,496	838	188,770	192,594
Recreational fishery dropoff mortality 2.04%	17	104	94	0	198	215
Tribal fishery dropoff mortality 8.7%	4	606	1,969	25	2,600	2,604
Total In-river Run	**3,845**	**94,147**	**96,559**	**862**	**191,568**	**195,413**

Table 2. Documentation of the methods used to sample 2003 Klamath River fall chinook run.

Sampling Location	Estimation Method	Agency
Hatchery Spawners		
Iron Gate Hatchery (IGH)	Direct count. All fish examined for fin clips, tags, marks. Systematic random sample ~10% bio-sampled for FL, scales, sex and all ads bio-sampled.	CDFG
Trinity River Hatchery (TRH)	Direct count. All fish bio-sampled for FL, fin-clips, marks sex. Scales collected from all ad-clipped fish and ~10% of non-ads for first two days sampled and 20% of all fish for all remaining days sampled.	CDFG
Natural Spawners		
Salmon River Basin	Mark-recapture carcass estimate. River is surveyed twice weekly. Bio-data (scales, FLs, marks) collected from all fresh carcasses.	CDFG,USFS
Scott River Basin	Mark-recapture carcass estimate. River is surveyed twice weekly. Bio-data (scales, FLs, marks) collected from all fresh carcasses.	CDFG
Shasta River Basin	Video count at lower river weir site. Bio-data (Scales, FLs, sex, marks) collected from carcasses upstream of site.	CDFG
Bogus Creek Basin	Video count above weir, direct carcass count below weir. Fish bio-sampled (scales, FLs, sex, fin-clips) in both areas; sampling fell below the 1:10 objective due to large number of carcasses.	CDFG
Klamath River main-stem (IGH to Shasta R)	Mark-recapture carcass estimate. River sections are surveyed once weekly. Bio data (scales, FLs' marks) collected from fresh carcasses.	USFWS
Klamath River main-stem (Shasta R to Indian Cr)	Redd count based on weekly surveys. Cumulative count based on flagging old redds. Adult estimate is redds times 2.	USFWS
Klamath River tributaries (above Reservation)	Periodic redd surveys. Prior weeks redds flagged, only new redds counted. Estimate is redds times 2 + live fish observed on last survey date.	USFS,CDFG
Klamath River tributaries (Yurok Reservation)	Only surveyed stream is Blue Creek. Jacks and adult count based on the peak weekly snorkle survey. Weekly dives performed Oct - Dec.	YT
Trinity River main-stem (above WCW)	Petersen mark-recapture run-size estimate. All fish at weir bio-sampled for FL, marks, fin-clips. Scale samples taken randomly from every other fish bio-sampled.	CDFG
Trinity River main-stem (below WCW)	Adult escapement estimate based on redd count times 2. Several surveys performed. Count is additive for survey period.	HVT
Trinity River tributaries (above Reservation)	Only 1 trib, Horse Linto Cr., situated between HVR and WCW location in 2003. Adult estimate based on weekly redd counts times 2. Previous weeks redds flagged to avoid double counting.	USFS
Trinity River tributaries (Hoopa Reservation)	Adult estimate based on redd surveys. Survey redd totals are cumulative. Final adult estimate is redds times 2.	HVT
Recreational Harvest		
Klamath River (below Hwy 101 bridge)	Estimate is based on a stratified access point creel survey. Bio-data (scales, FLs, marks, fin-clips) collected during angler interviews.	CDFG
Klamath River (Hwy 101 to Coon Cr. Falls)	Estimate is based on a stratified access point creel survey. Bio-data (scales, FLs, marks, fin-clips) collected during angler interviews.	CDFG
Klamath River (Coon Cr. Falls to IGH)	No creel census in '03. Adults estimated by a ratio of average upper to lower (Coon Ck. To Estuary) creel results from 1999-2002 . Jacks estimated from the jack proportion for the Klamath main-stem (IGH to Shasta).	CDFG
Trinity River Basin (above WCW)	Estimate is based on the return of reward tags placed on fish at weir. Return rate is applied to run-size estimate to estimate harvest.	CDFG
Trinity River Basin (below WCW)	Estimate based on a stratified roving/access creel survey. Bio-data (scales, FLs, marks, fin clips) collected during angler interviews.	HVT
Tribal Harvest		
Klamath River (below Hwy 101)	Stratified effort/catch surveys. Bio-data (FLs, scales, fin-clips) collected during net harvest interviews.	YT
Klamath River (Hwy 101 to Trinity mouth)	Stratified effort/catch surveys. Bio-data (FLs, scales, fin-clips) collected during net harvest interviews.	YT
Trinity River (Hoopa Reservation)	Two-stage stratified effort/catch surveys. Bio-data (FLs, scales, fin-clips) collected during net harvest interviews.	HVT
Fishery Dropoff Mortality		
Recreational angling dropoff mortality 2.04%	Not directly estimated. Assumed rate relative to fishery impacts = .02; relative to fishery harvest = .02/(1-.02).	KRTAT
Tribal net dropoff mortality 8.7%	Not directly estimated. Assumed rate relative to fishery impacts = .08; relative to fishery harvest = .08/(1-.08).	KRTAT

Table 3. Scale sampling locations and numbers of scales used for the 2003 Klamath River Basin fall chinook age-composition.

Sampling Location	Scales				Agency
	Unknown-age read [a/]	Known-age read [b/]	Not used [c/]	Total	
Hatchery Spawners					
Iron Gate Hatchery (IGH)	1,541	1,342	1,607	4,490	CDFG
Trinity River Hatchery (TRH)	3,680	2,325	302	6,307	HVT
Natural Spawners					
Salmon River carcass survey	792	0	56	848	CDFG, USFS
Scott River carcass survey	1,209	0	55	1,264	CDFG
Shasta River Weir and carcass	380	0	51	431	CDFG
Bogus Creek Weir	283	43	31	357	CDFG
Klamath River main-stem	483	2	9	494	USFWS
Upper Klamath River tributaries	55	0	0	55	CDFG, USFS
Willow Creek Weir	515	55	21	591	CDFG, HVT
Lower Trinity River carcass	45	3	3	51	HVT
Lower Trinity River tributaries	54	0	2	56	USFS
Recreational Harvest					
Upper Klamath River creel	0	0	0	0	CDFG
Lower Klamath River creel	1,392	87	47	1,526	CDFG
Upper Trinity River creel	0	0	0	0	CDFG
Lower Trinity River creel	77	7	3	87	HVT
Tribal Harvest					
Klamath River (below Hwy 101)	3,340	353	200	3,893	YT
Klamath River (Hwy 101 to Trinity R)	1,212	68	69	1,349	YT
Trinity River (Hoopa Reservation)	560	80	8	648	HVT
TOTAL	15,618	4,365	2,464	22,447	

a/ Scales from non-ad-clipped fish, mounted and read.

b/ Scales from ad-clipped, cwt fish, mounted and read; not all Klamath scales used in scale validation matrix.

c/ Scales from non-ad-clipped fish, mounted and not read, or un-readable; scales from non-ad-clipped fish, not mounted; scales from ad-clipped fish with no cwt; scales from ad-clipped, cwt fish, mounted and not read.

Table 4. Documentation of the methods used by the KRTAT to determine the age-composition of the 2003 Klamath River fall chinook run.

Sampling Location	Age Composition Method
Hatchery Spawners	
Iron Gate Hatchery (IGH)	Actual count; jack/adult structure from scale-age analysis.
Trinity River Hatchery (TRH)	Actual count; jack/adult structure from scale-age analysis, applied cwt age-distribution to the ad-clipped, non-cwt fish recovered.
Natural Spawners	
Salmon River Basin	Jack/adult structure from scale-age analysis.
Scott River Basin	Jack breakout <55 cm. Scales were used to apportion adult ages.
Shasta River Basin	Jack/adult structure from scale-age analysis.
Bogus Creek Basin	Jack/adult structure from scale-age analysis.
Klamath River main-stem (IGH to Shasta R)	USFW mark-recapture carcass survey; Schaefer estimate for total adults; jack/adult structure from scale analysis; total run = adults / (1-%jacks).
Klamath River main-stem (Shasta R to Indian Cr)	Used scale-age% from Klamath main stem (IGH to Shasta R) as surrogate to calculate jack and adult structure; adults = 2*redd counts; total run = adults/(1-%jacks).
Klamath River tributaries (above Reservation)	Adults =2*redd counts+ live adults observed; jacks/adult structure based on unweighted average age-structure from the Shasta, Scott, and Salmon Rivers (surrogate).
Klamath River tributaries (Yurok Reservation)	Number of jacks and adults observed during Blue Creek dive surveys; Salmon River scale-age analysis used as surrogate for adult age structure.
Trinity River main-stem (above WCW)	Calculated from total Willow Creek Weir (age structure from scales) population minus TRH (age-structure from scales) minus recreational harvest (jacks from harvest rate used in CDFG Megatable(MT); adults from
Trinity River main-stem (below WCW)	Age % from 51 scales collected in redd surveys for this area ; adults = 2*redd counts; total run = adults/(1-%jacks).
Trinity River tributaries (above Reservation)	Used scale data from 56 scales collected in Horse Linto, Willow Creek, and South Fork basins as surrogate to calculate jack and adult structure; adults = 2*redd counts; total run = adults/(1-%jacks).
Trinity River tributaries (Hoopa Reservation)	Used scale data from 56 scales collected in Horse Linto, Willow Creek, and South Fork basins as surrogate to calculate jack and adult structure; adults = 2*redd counts; total run = adults/(1-%jacks).
Recreational Harvest	
Klamath River (below Hwy 101 bridge)	Lower Klamath R. creel census, jack/adult structure from scale-age analysis
Klamath River (Hwy 101 to Coon Cr. Falls)	Lower Klamath R. creel census, jack/adult structure from scale-age analysis
Klamath River (Coon Cr. Falls to IGH)	Total adults as function of Lower Klamath creel, jack/adult structure from scale-age analysis of Upper Klamath Mainstem (IGH to Shasta) carcass survey.
Trinity River Basin (above WCW)	Jacks based on harvest rate; adult structure from scale-age analysis.
Trinity River Basin (below WCW)	Lower Trinity R. creel census; jack/adult structure from scale-age analysis.
Tribal Harvest	
Klamath River (below Hwy 101)	Total count; jack/adult structure from scale-age analysis.
Klamath River (Hwy 101 to Trinity mouth)	Total count; jack/adult structure from scale-age analysis.
Trinity River (Hoopa Reservation)	Total count; jack/adult structure from scale-age analysis.

Table 5a. 2003 Klamath River scale validation matrices.

Number

Read Age	Known Age 2	3	4	5	Total
2	7	0	0	0	
3	1	236	33	0	
4	0	17	243	0	
5	0	0	0	2	
Total	8	253	276	2	539

Percentage

Read Age	Known Age 2	3	4	5
2	0.88	0.00	0.00	0.00
3	0.13	0.93	0.12	0.00
4	0.00	0.07	0.88	0.00
5	0.00	0.00	0.00	1.00
Total	1.00	1.00	1.00	1.00

Table 5b. 2003 Trinity River scale validation matrices.

Number

Read Age	Known Age 2	3	4	5	Total
2	29	3	0	0	
3	1	1429	18	0	
4	0	20	970	0	
5	0	0	0	0	
Total	30	1452	988	0	2470

Percentage

Read Age	Known Age 2	3	4	5
2	0.97	0.00	0.00	0.00
3	0.03	0.98	0.02	0.00
4	0.00	0.01	0.98	0.00
5	0.00	0.00	0.00	0.00
Total	1.00	1.00	1.00	0.00

Table 6. 2003 Klamath River Basin age-composition calculation worksheet.

Hatchery spawners	# Grilse	# Adults	Total Run	CALCULATED AGE 2	3	4	5	Total	SCALE AGE PROPORTIONS	2	3	4	5	Total	Scales read or unknown CWTs	Redd counts
Iron Gate Hatchery	290	31970	32260	290	17427	14459	84	32260	scales	0.00890	0.54592	0.44258	0.00260	1.0	1,541	
									IGH cwts	15	585	770	4	1374	162	
Trinity River Hatchery	586	29805	30391	586	18155	11650	0	30391	scales	0.01979	0.60508	0.37513	0.00000	1.0	3680	
Hatchery spawner subtotal:	876	61775	62651	876	35582	26109	84	62651	TRH cwts	130	4201	2985	0	7316	280	
					proportion hatchery			0.321								
Natural Spawners																
Trinity River mainstem above WCW	1030	31074	32104	1030	19226	11621	226	32104	scales	0.03209	0.59887	0.36198	0.00705	1.0		
Trinity River mainstem below WCW	26	258	284	26	119	127	13	284	scales	0.09106	0.41766	0.44683	0.04444	1.0		129 redds
Salmon River Basin (includes Wooley Cr)	73	3302	3375	73	1245	2039	17	3375	scales	0.02165	0.36903	0.60427	0.00505	1.0	792	
Scott River	65	11988	12053	65	4399	7559	30	12053	scales	0.00539	0.36499	0.62715	0.00247	1.0	1,209	<56 jacks
Shasta River	155	4134	4289	155	2798	1325	11	4289	scales	0.03609	0.65239	0.30888	0.00263	1.0	380	
Bogus Creek	183	15018	15201	183	8258	6760	0	15201	scales	0.01212	0.54376	0.44413	0.00000	1.0	283	
									Bogus CWT	0	27	32	0	59	26	
Main stem Klamath (IGH to Shasta R)	237	14076	14313	237	6580	7407	89	14313	scales	0.01656	0.45969	0.51753	0.00621	1.0	483	
Main stem Klamath (Shasta R to Indian Cr)	61	3646	3707	61	1704	1919	23	3707	Upper main	0.01656	0.45969	0.51753	0.00621	1.0	Surrogate used	1823 redds
subtotal:	1,830	83,496	85,326	0 1,830	44,329	38,757	409	85,326								
				0.0054	0.0054	0.0054	0.0054		Unweighted Scott Shasta Salmon (SSS) - SURROGATE							
		Surrogate							SSS	0.02104	0.46214	0.51343	0.00338	1.0		Redds / Live adults
Klamath Tributaries																
Aiken Cr.	0	0	0	0	0	0	0	0	SSS	0.02104	0.46214	0.51343	0.00338			0 / 0
Beaver Cr.	5	224	229	5	106	117	1	229	SSS	0.02104	0.46214	0.51343	0.00338			77 / 70
Bluff Cr.	0	20	20	0	9	10	0	20	SSS	0.02104	0.46214	0.51343	0.00338			5 / 10
Boise Cr.	0	0	0	0	0	0	0	0	SSS	0.02104	0.46214	0.51343	0.00338			0 / 0
Camp Cr.	7	345	352	7	163	181	1	352	SSS	0.02104	0.46214	0.51343	0.00338			161 / 23
Clear Cr.	7	310	317	7	146	163	1	317	SSS	0.02104	0.46214	0.51343	0.00338			154 / 2
Dillon Cr.	1	68	69	1	32	36	0	69	SSS	0.02104	0.46214	0.51343	0.00338			34 / 0
Elk Cr.	7	321	328	7	152	168	1	328	SSS	0.02104	0.46214	0.51343	0.00338			159 / 3
Grider Cr.	5	233	238	5	110	122	1	238	SSS	0.02104	0.46214	0.51343	0.00338			116 / 1
Horse Cr.	0	8	8	0	4	4	0	8	SSS	0.02104	0.46214	0.51343	0.00338			4 / 0
Independence Cr.	0	0	0	0	0	0	0	0	SSS	0.02104	0.46214	0.51343	0.00338			0 / 0
Indian Cr.	0	0	0	0	0	0	0	0	SSS	0.02104	0.46214	0.51343	0.00338			0 / 0
Irving Cr.	0	0	0	0	0	0	0	0	SSS	0.02104	0.46214	0.51343	0.00338			0 / 0
Perch Cr.	0	0	0	0	0	0	0	0	SSS	0.02104	0.46214	0.51343	0.00338			0 / 0
Red Cap Cr.	3	126	129	3	59	66	0	129	SSS	0.02104	0.46214	0.51343	0.00338			60 / 6
Thompson Cr.	2	106	108	2	50	56	0	108	SSS	0.02104	0.46214	0.51343	0.00338			53 / 0
Ti Cr.	0	0	0	0	0	0	0	0	SSS	0.02104	0.46214	0.51343	0.00338	0.98		0 / 0
Klamath Tribs subtotal	38	1761	1799	38	831	924	6	1799			0.47207	0.52447	0.00345			823 / 115
Trinity Tributaries																
Horse Linto Cr.	62	344	406	62	77	259	8	406	scales	0.15285	0.18998	0.63865	0.01852	1.0	56	172 redds
Cedar Cr (trib to Horse Linto)	47	258	305	47	58	195	6	305	scales	0.15285	0.18998	0.63865	0.01852	1.0		129 redds
subtotal	109	602	711	109	135	454	13	711								
Non-Reservation Misc. tribs sub total	147	2363	2510	147	966	1378	19	2510								
Reservation Tributaries-Hoopa Valley																Redds / Live adults
Campbell Cr.	0	0	0	0	0	0	0	0	scales	0.15285	0.18998	0.63865	0.01852			0 / 0
Hostler	1	6	7	1	1	5	0	7	scales	0.15285	0.18998	0.63865	0.01852			3 / 0
Mill	53	292	345	53	65	220	6	345	scales	0.15285	0.18998	0.63865	0.01852			146 / 0
Pine Cr.	0	0	0	0	0	0	0	0	scales	0.15285	0.18998	0.63865	0.01852			0 / 0
Soctish	1	6	7	1	1	5	0	7	scales	0.15285	0.18998	0.63865	0.01852			3 / 0
Supply Cr.	4	24	28	4	5	18	1	28	scales	0.15285	0.18998	0.63865	0.01852			12 / 0
Tish Tang Cr.	21	116	137	21	26	87	3	137	scales	0.15285	0.18998	0.63865	0.01852			58 / 0
Others	0	0	0	0	0	0	0	0	scales	0.15285	0.18998	0.63865	0.01852			0 / 0
subtotal	80	444	524	80	100	335	10	524	scales	0.15285	0.18998	0.63865	0.01852			222
Reservation Tributaries-Yurok																
Blue Cr.	31	1094	1125	31	413	676	6	1125	Salmon R	not used	0.36903	0.60427	0.00505	0.98		
reservation tributaries subtotal	111	1538	1649	111	513	1011	16	1649								
Natural spawner subtotal:	2088	87397	89485	2088	45808	41146	444	89485		87398						
Total spawner subtotal:	**2964**	**149172**	**152136**	**2964**	**81390**	**67255**	**528**	**152136**								
Angler Harvest																
Klamath River (below Hwy 101)	180	1589	1769	180	816	770	4	1769	LRC scales	0.10263	0.45506	0.44015	0.00216	1.00	1,392	
									LRC cwts	4	36	17	0	57	3	
Klamath River (Hwy 101 to Coon Cr)	369	3336	3705	369	1718	1611	8	3705	LRC scales	0.10263	0.45506	0.44015	0.00216	1.00		
									LRC cwts	3	92	41	0	136	7	
Klamath River (Coon Cr. to IGH)	40	2397	2437	40	1120	1261	15	2437		0.01656	0.45969	0.51753	0.00621	1.00	Surrogate -upper main	
									URC cwts	no survey	in 2003			0		
Trinity River (below Willow Cr. Weir)	52	509	561	52	304	205	0	561	scales	0.09288	0.54437	0.36275	0.00000	1.00	77	
									lower cwts	1	4	5	0	10	0	
Trinity River (above Willow Cr. Weir)	175	1870	2045	175	1116	754	0	2045		0.09288	0.54437	0.36275	0.00000	1.00	Surrogate -lowr creel	
Angler harvest subtotal:	816	9,701	10,517	816	5,074	4,601	26	10,517	upper cwts	24	228	162	0	414		
Indian Net Harvest																
Klamath River (below Hwy 101)	15	22548	22563	15	3947	18362	239	22563	scales	0.00068	0.16933	0.81921	0.01078	1	3,340	
									YTFP EST cwt	0	196	263	1	460	32	
Klamath River (101 to Trinity R)	17	4578	4595	17	1636	2897	44	4595	scales	0.00377	0.35357	0.63276	0.00990	1	1,212	
									YTFP MU cwt	0	42	48	0	90	14	
Trinity River	12	2771	2783	12	1390	1381	0	2783	scales	0.00448	0.49685	0.49867	0.00000	1	560	
Net harvest subtotal:	44	29897	29941	44	6973	22640	283	29941	Hoopa cwts	0	50	37	0	87	2	
Total harvest	**860**	**39598**	**40458**	**860**	**12047**	**27241**	**309**	**40458**								
Totals																
In-river run and escapement	3824	188770	192594	3824	93437	94496	837	192594								
Angling dropoff mortality (2.04%)	17	198	215	17	104	94	0	215	0.02041 angler dropoff mort rate on harvest (not total contacts)							
Net dropoff mortality (8.7%)	4	2600	2604	4	606	1969	25	2604	0.08696 net dropoff mort rate on harvest (not total contacts)							
Total in-river run	3845	191568	195413	3845	94147	96559	862	195413								
				2.0%	48.2%	49.4%	0.4%									

Appendix A. Klamath River – 2003 Details.

Iron Gate Hatchery
After the following discussion, the KRTAT decided to use scale-age-based determination of the jack proportion at IGH. A total of 2,883 scales were used of which 1,342 were from known-age cwt fish.

Desma Williams described a concern wherein the scale mounting process was potentially compromised by scale mounting error which could lead to an error with the validation matrix. The potential error was isolated to specific mounters and by excluding the scales taken from known-age cwt fish mounted by these staff, she preserved 539 of 2,065 validation scales. The KRTAT concluded that at the cost of reduced sample size this process resulted in an un-biased validation matrix and provided a basis for correction of reader bias.

Bogus Creek
The KRTAT determined that scale samples used from Bogus Creek were representative of the true age structure. There were a total of 326 scales used of which 43 were from known-age cwt fish. Scale-age proportions were used to apportion the total Bogus Creek run estimate into all ages.

Shasta River
The KRTAT determined that scale samples collected in Shasta River were representative of the run estimate. There were a total of 379 scales used of which none were from known-age cwt fish.

Scott River
Only 1,209 scales were examined of which none were from known-age cwt fish. The Team concluded that the scale sample was not sufficient to adequately represent jacks which appeared to be in very low number this year. Accordingly, length frequency analysis of over 5,000 measured fish suggested 55 cm and less would be an appropriate length separation for jacks. Accordingly, the jack proportion (0.00539) was estimated by the length frequency "cut-off" method. The adult age structure was estimated using the scale-age data.

Salmon River
The KRTAT determined that scale-based age proportions were representative of the 2003 Salmon River run. A total of 792 scales were examined with none from known-age cwt fish.

Klamath River miscellaneous tributaries
Due to insufficient collection of scales, these tributaries were to be proportioned by age according to the un-weighted average proportions resulting from analysis of the Salmon, Scott, and Shasta Rivers.

Klamath River main-stem
For IGH to Shasta River section, 485 scales were used which resulted in a jack proportion of 0.017. Isaac Sanders had reported an adult total of 14,076 and a jack estimate of 292 (0.02) using the Schaeffer and Petersen mark-recapture methods respectively. Mr. Sanders expressed concern with his estimated total jacks using the Petersen method due to low marking rates. The Team concluded to apply the jack proportion based on scale ageing given the large sample size and its representational nature relative to the total estimate.

Accordingly, the total adult estimate was divided by one minus the proportion of jacks estimated by scale analysis. Next the adult total was apportioned by age using the scale-age data. A similar approach for age composition was applied to the main-stem area between Shasta River and Indian Creek total spawners which were estimated by redd counts multiplied by two.

Lower Klamath River creel
For both sub-areas (above/below Coon Creek Falls) scale-age proportions were used to apportion all ages for the estimated harvest totals. A total of 1,496 scales were examined of which 87 were taken from known-age cwt fish.

Upper Klamath River creel

In 2003, this area was not directly sampled as was done for the previous four years (1999 through 2002). Instead, the total harvest was estimated for adults by comparing the ratio of average of upper to lower creel results from 1999-2002. Second, the jack proportion of the estimated total harvest was approximated by using that seen in the upper Klamath main-stem spawner survey data (IGH to Shasta River). These main-stem spawner scale data were also used to apportion adult age classes in this un-monitored fishery. Using the upper Klamath main-stem age structure was justified in at least two ways; first, past years' data indicate that the catch in this fishery occurs primarily in the above Shasta to IGH area, and second, the previous year's data, in which direct monitoring of the fishery occurred, resulted in very similar jack proportions in this fishery when compared to the spawner survey data above Shasta River

Yurok Tribal fishery – estuary

The estuary fishery scale sample yielded a jack proportion of 0.00068. This result came from the examination 3,693 scales of which 353 were from known-age cwt fish. The KRTAT agreed that scale-age proportions should be applied to the total estimated harvest for this fishery.

Yurok Tribal fishery – Hwy 101 bridge to Weitchpec

Yurok harvest in the mid and upper-Klamath area was segregated into jacks and adults based upon scale ageing. A total of 1,280 scales were examined of which 68 came from known-age cwt fish.

Blue Creek

Snorkel surveys were used to produce total escapement estimate. Visual counts revealed 31 jacks and 1,094 adults. Adult age composition was approximated using the age structure of Salmon River as a surrogate.

Appendix B. Trinity River – 2003 Details.

Trinity River Hatchery
Sampling for scales was conducted in a systematic random manner. On the first two days of sampling the selection was for every tenth fish and every ad-clipped fish. However, for the balance of the sampling, a systematic random sample in which every fifth fish was selected for a sample. A total of 6,005 scales were aged of which 2,325 scales came from cwt fish both randomly and non-randomly selected. This was the largest validation component for the entire Trinity River ageing project Jacks were identified by scales, as were the age proportions for adult classes.

Upper Trinity River creel
There were no scales recovered from this fishery as no creel census was implemented in 2003. Total harvest was estimated as 2,045 fish using the mark-recapture method for reward tag returns of WCW marked fish. KRTAT decided that the best method to apportion ages to this total was to first utilize specific cwt information on age as summarized by Wade Sinnen. The approach depends upon the recovery of reward/non-reward program tags applied at the Willow Creek Weir (WCW) and subsequently recovered by the program. In his analysis, a cwt "run-size" allocates proportions of tag codes observed at the TRH recovery area to natural spawning areas below TRH to WCW and the recreational fishery in this zone. In 2003, Wade Sinnen estimated a total of 413 of the 2,045 fish in the harvest estimate to be of specific tag codes. These codes explained the age structure for this subset of harvest. The balance, 1,632 fish, were apportioned by age (2, 3, 4, and 5 year old) using the corrected scale-age proportions from the lower Trinity creel census.

The Team recommended that, assuming funds allow, CDFG should consider re-establishing a creel census to enhance the bio-sampling of this fishery in future years.

Lower Trinity River creel
A total of 84 scales were aged of which 7 were from known-age cwt fish. Team concluded that sufficient scale samples were drawn to enable direct ageing by scales for all ages.

Upper Trinity River natural escapement
The methods used for ageing the Trinity River run above WCW are similar to those used in the estimation of the population, apportioned to three general recovery areas; Trinity River Hatchery, Trinity upper-basin natural spawning escapement, and recreational harvest. At WCW a systematic random sampling (every other fish) of all fish examined produces a collection of scales for program marked fish, some of which are ad-clipped (Trinity River Hatchery origin). Validation of WCW read scales is accomplished with known-aged cwt fish later recovered at either TRH, recreational creel, or spawning grounds which are also referenced to WCW by a unique "program tag" (spaghetti tag applied at WCW with unique identifying number). A total of 570 scales were collected at WCW. Of these, 55 cwt records were subsequently recovered and used in the scale-age validation matrix.

An age-structure for fish passing above WCW is estimated using these scales and a few known-age cwt fish found in upper river areas. Next, specific age structures are estimated for fish returning to TRH and the recreational fishery. These proportions are applied to the total hatchery escapement and estimated fishery harvest respectively providing totals by age within area. These totals are next deducted from the WCW run apportioned by age leaving an age-structure for the natural escapement in the Trinity River natural spawning grounds.

Lower Trinity River natural escapement
The lower Trinity natural estimation area included total spawners estimated in both main-stem and tributary sub-areas. These surveys also collected a total 48 and 54 scales from carcasses for the mainstem and tributary sub-areas respectively. Three of the 48 scales sampled in the mainstem were also associated with the recovery of cwt's. The Team concluded that scale collections were adequate to provide age distributions for both sub-areas for all ages. Age structures based on the scale-ages generated for each sub-area.

Hoopa Valley Tribal fishery

A total of 640 scales were aged of which 80 were from known-age cwt fish. Total harvest was apportioned by age using the scale-age proportions for ages 2-5.

Appendix C. 2003 Klamath River scale-age analysis.

Unknown scales age-composition as read

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL	
BOGUS	3	159	121	0	283	
LRC	125	682	582	3	1392	
IGH	12	868	657	4	1541	
SALMON	15	332	441	4	792	
SCOTT	0	505	701	3	1209	
SHASTA	12	247	120	1	380	
YTFP EST	2	855	2447	36	3340	
YTFP M&U	4	492	704	12	1212	
MAINSTEM	7	238	235	3	483	
UR TRIBS	0	28	25	2	55	
	180	4406	6033	68	10687	Total unknown scales read

Unknown scales corrected age proportions (Kimura method)

		AGE 2	AGE 3	AGE 4	AGE 5	TOTAL
BOGUS	p	0.01212	0.54376	0.44413	0.00000	1.00000
LRC	p	0.10263	0.45506	0.44015	0.00216	1.00000
IGH	p	0.00890	0.54592	0.44258	0.00260	1.00000
SALMON	p	0.02165	0.36903	0.60427	0.00505	1.00000
SCOTT	p	0.00000	0.36697	0.63055	0.00248	1.00000
SHASTA	p	0.03609	0.65239	0.30888	0.00263	1.00000
YTFP EST	p	0.00068	0.16933	0.81921	0.01078	1.00000
YTFP M&U	p	0.00377	0.35357	0.63276	0.00990	1.00000
MAINSTEM	p	0.01656	0.45969	0.51753	0.00621	1.00000
UR TRIBS	p	0.00000	0.48433	0.47931	0.03636	1.00000

Known CWT ages

	AGE 2	AGE 3	AGE 4	AGE 5	TOTAL	UNKNOWN
BOGUS	0	27	32	0	59	26
LRC	7	128	58	0	193	10
IGH	15	585	770	4	1374	162
SALMON	0	0	0	0	0	0
SCOTT	0	0	0	0	0	0
SHASTA	0	0	0	0	0	0
YTFP EST	0	196	263	1	460	32
YTFP M&U	0	42	48	0	90	14
MAINSTEM	0	1	3	0	4	1
UR TRIBS	0	0	0	0	0	0
					2180	245
LRC - lo	4	36	17	0	57	3
LRC - mid	3	92	41	0	136	7
YTFP MID	0	3	3	0	6	0
YTFP UP	0	39	45	0	84	14

Validation Matrix

		Known Age 2	3	4	5	
	2	7	0	0	0	
Read	3	1	236	33	0	
Age	4	0	17	243	0	
	5	0	0	0	2	
	Total	8	253	276	2	539

Percentages from validation matrix

		Known Age 2	3	4	5
	2	0.88	0.00	0.00	0.00
Read	3	0.13	0.93	0.12	0.00
Age	4	0.00	0.07	0.88	0.00
	5	0.00	0.00	0.00	1.00
	Total	1.00	1.00	1.00	1.00

Appendix D. 2003 Trinity River scale-age analysis.

WCW 03 = Willow Ck. Weir — ***Cwt Age***

Scale / Ages	no cwt	2	3	4	5	
unreadable	17	0	1	3	0	21
2	16	0	0	0	0	16
3	308	0	30	1	0	339
4	189	0	0	24	0	213
5	2	0	0	0	0	2
	532	0	31	28	0	591

LOWTRINREC = Lower Trinity Recreational — ***Cwt Age***

Scale / Ages	no cwt	2	3	4	5	
unreadable	3	0	0	0	0	3
2	7	1	0	0	0	8
3	42	0	3	0	0	45
4	28	0	0	3	0	31
5	0	0	0	0	0	0
	80	1	3	3	0	87

HUPANET = Hoopa Tribal Harvest — ***Cwt Age***

Scale / Ages	no cwt	2	3	4	5	
unreadable	8	0	0	0	0	8
2	3	0	0	0	0	3
3	279	0	46	0	0	325
4	278	0	0	34	0	312
5	0	0	0	0	0	0
	568	0	46	34	0	648

TRH = Trinity River Hatchery — ***Cwt Age***

Scale / Ages	no cwt	2	3	4	5	
unreadable	139	3	34	30	0	206
2	79	28	3	0	0	110
3	2284	1	1350	17	0	3652
4	1413	0	20	906	0	2339
5	0	0	0	0	0	0
	3915	32	1407	953	0	6307

HOOPATRIBCARCASS = Lower Trinity Tribs (No Scales or CWTs) — ***Cwt Age***

Scale / Ages	no cwt	2	3	4	5	
unreadable	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
	0	0	0	0	0	0

UPTRINREC = Upper Trinity Recreational (No CWTs or scales.) — ***Cwt Age***

Scale / Ages	no cwt	2	3	4	5	
unreadable	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
	0	0	0	0	0	0

LOWTRINCARCASS = Lower Trinity Mainstem — ***Cwt Age***

Scale / Ages	no cwt	2	3	4	5	
unreadable	3	0	0	0	0	3
2	4	0	0	0	0	4
3	19	0	0	0	0	19
4	20	0	0	3	0	23
5	2	0	0	0	0	2
	48	0	0	3	0	51

TribsAboveHoopa = Lower Trinity Tribs above Hoopa — ***Cwt Age***

Scale / Ages	no cwt	2	3	4	5	
unreadable	2	0	0	0	0	2
2	8	0	0	0	0	8
3	11	0	0	0	0	11
4	34	0	0	0	0	34
5	1	0	0	0	0	1
	56	0	0	0	0	56

POOLED data from all areas: **Scale age-CWT age matrix**.
(Includes only fish with both scale age and CWT known age.)

2003 3 x 3 VALIDATION MATRIX	2	3	4	5	
2	29	3	0	0	
3	1	1429	18	0	
4	0	20	970	0	
5	0	0	0	0	(No 5 yr old recov.)

Scale-CWT age matrix of proportions of column sums.

	2	3	4	5
2	29.0000	0.0021	0.0000	#DIV/0!
3	1.0000	0.9862	0.0182	#DIV/0!
4	0.0000	0.0138	0.9818	#DIV/0!
5	0.0000	0.0000	0.0000	#DIV/0!
	30.0000	1.0021	1.0000	#DIV/0!

Corrected Scale age proportion vectors for scale-aged 2 - 5 fish.

From 2003 data correction worksheet

	Willow Creek Weir	Hoopa Tribal	Lower Trinity	TRH	Lower Trinity	Upper Trinity	Upper Trin			
# scales	515	560	77	3680	45	0	54	4931		
Age	WCW	NET HARVEST	REC HARVEST	HATCHERY	CARCASS	REC HARVEST	Tribs	Age	TRH	Upper Trinity Rec Harvest
2	0.0278	0.0045	0.0929	0.0198	0.0911	lower Rec	0.1529	2	586	175
3	0.5965	0.4969	0.5444	0.6051	0.4177	lower Rec	0.1900	3	18155	1116
4	0.3723	0.4987	0.3627	0.3751	0.4468	lower Rec	0.6386	4	11650	754
5	0.0035	0.0000	0.0000	0.0000	0.0444	lower Rec	0.0185	5	0	0
	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000		30391	2045

UNKNOWN CWTS	2		280	1				
CWTS	Willow Creek Weir	Hoopa Tribal	Lower Trinity	TRH	Lower Trinity	(Estimated) Upper Trinity	(Estimated) Upper Trinity	
Age	WCW	NET HARVEST	REC HARVEST	HATCHERY	CARCASS	REC HARVEST	Natural	Proportions
2	0	0	1	130	0	24	84	0.03209
3	0	50	4	4201	0	228	3249	0.59887
4	0	37	5	2985	3	162	2309	0.36198
5	0	0	0	0	0	0	0	0.00705
	0	87	10	7316	3	414	5642	1.00000

Used: Combo of #s:
WCW (J&A scales)
- TRH (J&A scales)
- Rec harvest above WCW (J & A scales)
+ Fudge

Total Adult + Jacks
Natural Escapement, Trinity basin above WCW: Apportioned to age structure.

		Age	WCW age proportions	TRH + Rec above WCW + Nat Escapement	Add each season Fudge	**Apportioned Natural Escapement** minus TRH #s minus above WCW creel #s
Rec above WCW	2,045	2	0.02776	1792	0	1030
TRH	30,391	3	0.59648	38497	0	19226
Naturals	32,104	4	0.37225	24025	0	11621
Total	64,540	5	0.00351	226	0	226
			1.00000	64540		32104

TRH fall chinook return, apportioned by corrected age 2 - 5 structure

Total Chinook	30391
minus Ad-Clip Non-CWT	280
minus CWT chinook	7316
to apportion	22795

2003 TRH Special aging:
Because Ad-clipped fish weren't sampled the same during the entire sampling period at TRH, the ad-clipped non-CWT fish (n=280) were aged by known CWTs scales.

Corrected Non-Ad-Clip chinook age 2 - 5 proportion vector

Age	Non-Ad Scale Scales	Non-Ad Scale apportioned	CWT age comp	Ad Clipped Non-CWT Apportioned	+CWT #s	TRH return apportioned by 2-5 proportions	Proportions
2	0.0198	451	0.0178	5	130	586	0.01928
3	0.6051	13793	0.5742	161	4201	18155	0.59737
4	0.3751	8551	0.4080	114	2985	11650	0.38335
5	0.0000	0	0.0000	0	0	0	0.00000
	1	22795	1	280	7316	30391	1

n=3680

TRH Upper Rec Harvest

			Scales	non-CWT #s	+CWT #s	Total	Proportions
Total Chinook	2045	2	0.0929	151	24	175	0.0858
minus CWT chinool	414	3	0.5444	888	228	1116	0.5457
to apportion	1631	4	0.3627	592	162	754	0.3685
Surrogate L.Trin harvest		5	0.0000	0	0	0	0.0000
			1	1631	414	2045	1